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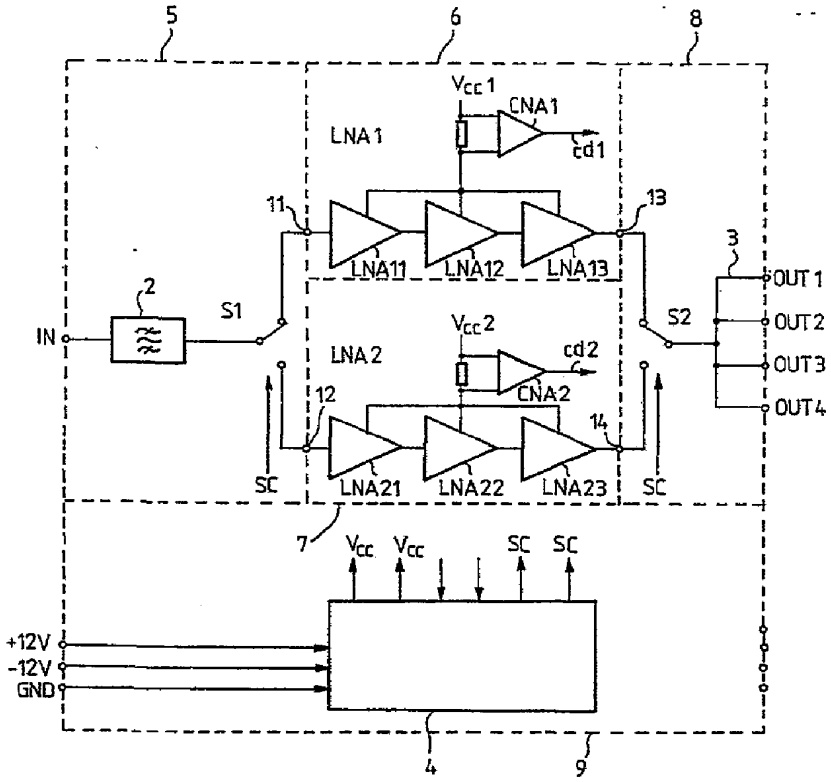
(54) Title: HIGH-FREQUENCY AMPLIFIER UNIT WITH A HOT STANDBY REDUNDANCY

(57) Abstract

The invention relates to a high-frequency amplifier unit replicated on the hot standby principle, comprising switching means (S1, S2) for connecting a signal to be amplified through two alternative amplifier branches (LNA1, LNA2). The amplifier unit of the invention is of modular structure in such way that the two amplifier branches (LNA1, LNA2) are positioned in their own separate structural modules (6, 7) detachable from the amplifier unit without breaking the signal path passing through the structural module containing the other amplifier branch.



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High-frequency amplifier unit with a hot standby redundancy

The invention relates to a high-frequency amplifier unit replicated on the hot standby principle, comprising switching means for connecting a signal to be amplified through two alternative amplifier branches.

To improve the sensitivity of a radio receiver, an antenna amplifier or preamplifier is often placed at the top of the antenna mast in close vicinity to the antenna, whereby a signal received by the antenna can be amplified before it is applied through an antenna cable from the antenna mast to the primary receiver positioned at the foot of the mast. Alternatively, or additionally, it is possible to use a high-frequency amplifier also in the vicinity of the receiving equipment, for instance, as a distribution amplifier when the antenna signal is to be distributed to several receiving apparatuses. The amplifier is thereby positioned before the signal branching means.

To increase reliability and redundancy, amplifiers are often replicated on the hot standby principle: both the amplifier in use and the amplifier in reserve assumes a full operating mode, so that when the amplifier in use fails, the signal can be passed immediately to the standby amplifier without interfering with the reception.

The object of the present invention is to provide a high-frequency amplifier unit replicated on the hot standby principle and being advantageous in structure in view of maintenance.

This is achieved by means of a high-frequency unit of the type disclosed in the introduction, which

according to the invention is characterized in that the amplifier unit is of modular structure, the two amplifier branches being positioned in separate structural modules detachable without breaking the signal path going through the structural module containing the other amplifier branch.

By virtue of the invention, the operation of the amplifier unit will not be interrupted and the signal quality remains unimpaired, even though one of the replicated amplifier branches fails and has to be replaced. In prior art amplifier units, the structure has been such that when one of the amplifiers fails, it has been necessary to remove the whole amplifier unit from operation and detach it, which has deteriorated the sensitivity of the receiver by more than 6 dB.

In the following the invention will be described in greater detail by means of an embodiment with reference to the attached figure, which is a block diagram of a high-frequency amplifier unit according to the invention and its modular structure.

The figure shows a high-frequency amplifier unit which is a distribution or branching amplifier positioned on the antenna line in the vicinity of a receiving equipment. The distribution amplifier amplifies an antenna signal before it is distributed to a number of receivers. Alternatively, the high-frequency amplifier unit may be a preamplifier or antenna amplifier positioned e.g. in the antenna mast.

The amplifier unit comprises a bandpass filter 2 connected to an antenna input IN so as to extract a desired frequency band from a signal received from the antenna. The operation of the amplifier unit is further assured by replicating it on the hot standby

principle. For this purpose the amplifier unit comprises at least two high-frequency amplifier branches LNA1 and LNA2. The first branch LNA1 is formed by three series-connected high-frequency amplifiers LNA11, LNA12 and LNA13, and the second branch LNA2 is correspondingly formed by three series-connected high-frequency amplifiers LNA21, LNA22 and LNA23. If required, the number of amplifiers in the branches can be decreased or increased. One of the branches serves as an active amplifier branch through which the signal is applied, while the other branch is in reserve and ready for operation, that is, assumes a hot standby mode. For the selection of the amplifier branch, the amplifier unit comprises a change-over switch S1 positioned in the input, and a change-over switch S2 positioned in the output. The change-over switch S1 connects the output of the filter 2 to the input of the amplifier branch LNA1 or LNA2, and the change-over switch S2 connects the output of the amplifier branch LNA1 or LNA2 to the input of an output branching means 3.

The amplifier unit further comprises a control unit 4 which generates separate operating voltages V_{cc1} and V_{cc2} for the amplifier branches LNA1 and LNA2. The control unit 4 monitors the condition of the amplifier branches LNA1 and LNA2 by observing their power consumption by means of measuring circuits formed by resistors R1 and R2 and differential amplifiers CNA1 and CNA2, respectively. The measuring circuits produce signals cd1 and cd2 proportional to the power consumption of the amplifier branches LNA1 and LNA2, respectively. These signals are applied to the control unit 4. When the control unit 4 detects, e.g. in the situation of the figure on the basis of the signal cd1, that the

amplifier branch LNA 1 has a failure, it immediately changes the state of a switch control signal sc so that the change-over switches S1 and S2 switch the received signal to pass through the amplifier branch LNA2.

The mechanical and electrical structure of the amplifier unit of the invention is realized as a modular structure in such a way that the two amplifier branches LNA1 and LNA2 with their amplifiers and measuring circuits are positioned in separate structural modules 6 and 7, respectively, which are detachable without breaking the alternative signal path passing through the structural module containing the remaining amplifier branch. As used in this connection, the structural module refers to a printed board or other similar structural element which can be positioned e.g. in a common subrack with other structural modules. Neither one of the change-over switches S1 and S2 nor the control unit 4 is positioned in these amplifier branch modules. In the preferred embodiment of the invention, the bandpass filter 2 and the change-over switch S1 for the input signal are positioned in a separate detachable structural module 5. The outputs of the change-over switch S1 are connected to output terminals 11 and 12 in the module 5. When the module 5 is installed ready for use, the output terminals 11 and 12 are connected to respective input terminals in modules 6 and 7. The branching means 3 and the output signal change-over switch S2 are also positioned in a separate detachable structural module 8. The inputs of the change-over switch S2 are connected to the input terminals 13 and 14 in the module 8. When the module 8 is installed ready for use, the input terminals 13 and 14 are connected to respective output terminals in the

modules 6 and 7. In the amplifier unit of the figure, the control unit 4 is also positioned in its own separate detachable structural module 9.

In the situation of the figure, for instance, where the change-over switches S1 and S2 apply the signal through the amplifier branch LNA1, the signal path goes only through the modules 5, 6 and 8, whereby the module 7 can be detached from the amplifier unit without breaking the signal path in use. Correspondingly, when the switches S1 and S2 apply the signal through the amplifier branch LNA2, the signal path goes only through the modules 5, 7 and 8, and the amplifier module 6 can be easily replaced, if required.

The figure and the description related to it are only intended to illustrate the present invention. In its details, the amplifier unit of the invention may vary within the scope of the attached claims.

Claims:

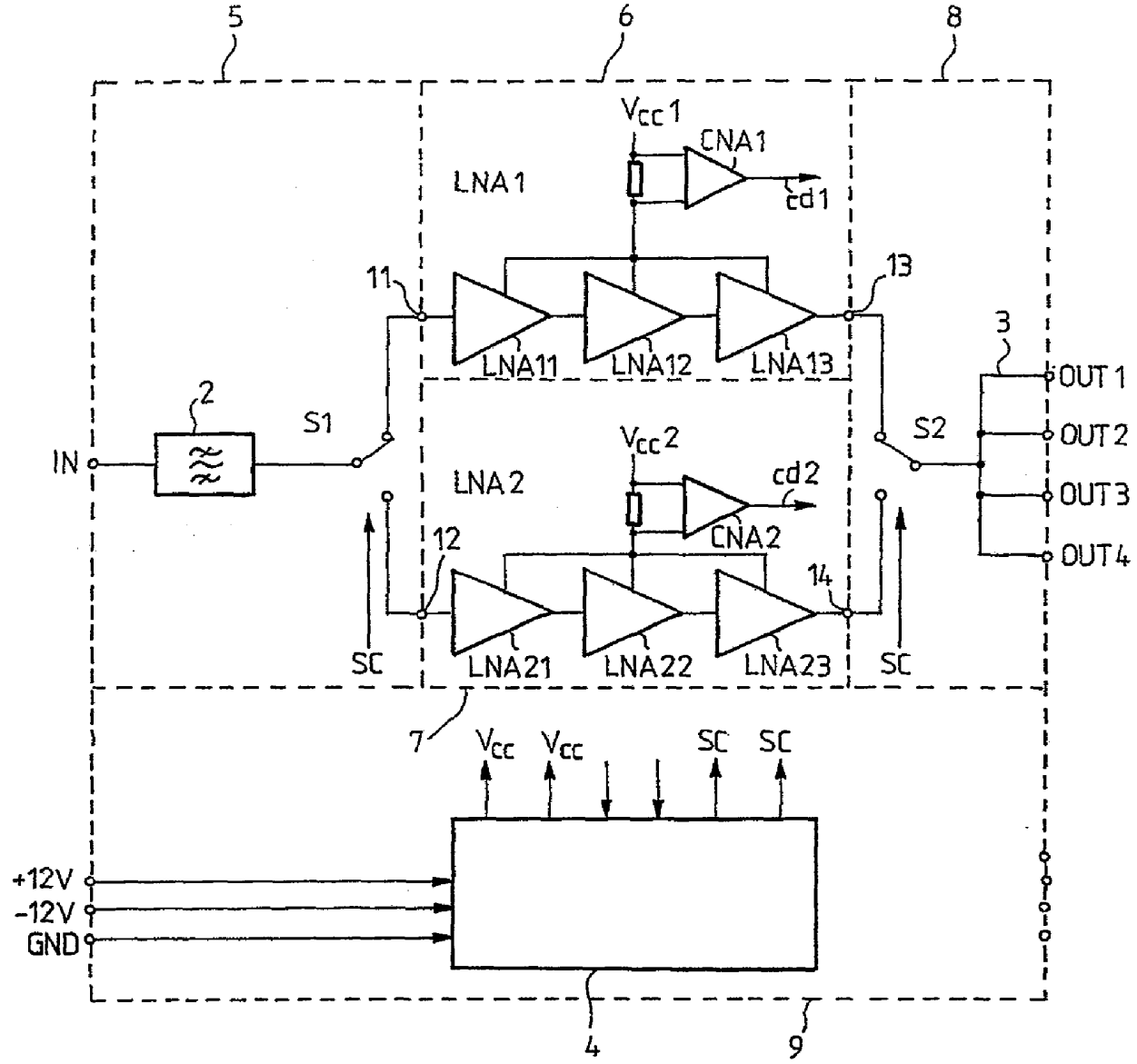
1. High-frequency amplifier unit replicated on the hot standby principle, comprising switching means (S1, S2) for connecting a signal to be amplified through two alternative amplifier branches (LNA1, LNA2), characterized in that the amplifier unit is of modular structure, the two amplifier branches (LNA1, LNA2) being positioned in separate structural modules (6, 7) detachable without breaking the signal path passing through the structural module containing the other amplifier branch.

2. High-frequency amplifier unit according to claim 1, characterized in that the switching means comprise a change-over switching means (S1) positioned in the input of the amplifier unit for connecting said input to one of the structural amplifier modules (6, 7); and a change-over switching means (S2) positioned in the output of the amplifier unit for connecting said output to one of the structural amplifier modules (6, 7), and that both change-over switching means (S1, S2) are positioned in their own separate detachable structural modules (5, 8).

3. High-frequency amplifier unit according to claim 1 or 2, characterized in that the amplifier unit comprises a control unit (4) which monitors the operation of the amplifier branches (LNA1, LNA2) and controls the switching means (S1, S2) and which is positioned its own separate detachable structural module (9).

4. High-frequency amplifier unit according to any of the preceding claims, characterized in that both amplifier branches (LNA1, LNA2)

comprise one amplifier or several series-connected amplifiers.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6
8
Vcc1
CNA1
LNA1
cd1
11
13
3
LNA11
LNA12
LNA13
OUT 1
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S1
S2
IN
Vcc2
cd2
LNA2
OUT 2
OUT 3
OUT 4
12
14
CNA2
SC
LNA21
LNA22
LNA23
SC
7
Vcc
Vcc
SC
SC
+12V
-12V
GND
4
9